

2005年 1月31日 11時07分

ASAMURA 81-332461239

NO. 1233 P. 7



US006310968B1

(12) **United States Patent**
Hawkins et al.

(10) Patent No.: **US 6,310,968 B1**
(45) Date of Patent: **Oct. 30, 2001**

(54) **SOURCE-ASSISTED ATTENUATION
CORRECTION FOR EMISSION COMPUTED
TOMOGRAPHY**

(75) Inventors: William C. Hawkins, Shaker Heights;
Daniel Gagnon, Twinsburg, both of OH
(US)

(73) Assignee: Picker International, Inc., Highland
Heights, OH (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

This patent is subject to a terminal dis-
claimer.

(21) Appl. No.: 09/198,787

(22) Filed: Nov. 24, 1998

(51) Int. Cl. G06K 9/08

(52) U.S. Cl. 382/131; 250/363.04

(58) Field of Search 382/131, 128,
382/129; 250/363.04; 378/4; 364/414

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,872,648 * 6/1987 Mattson et al. 378/4
5,210,421 * 5/1993 Gullberg et al. 250/363.04
5,338,936 8/1994 Gullberg et al.
5,479,021 * 12/1995 Morgan et al. 250/363.04
5,539,335 * 9/1996 Zeng et al. 250/363.04
5,814,817 * 9/1998 Gullermond et al. 250/363.04
6,008,493 * 12/1999 Shao et al. 250/363.04

OTHER PUBLICATIONS

X. Concor, et al., "A New Approach to the Emission Com-
puterized Tomography Problem: Simultaneous Calculation

of Attenuation and Activity Coefficients," *IEEE Trans. On
Nucl. Sci.*, vol. NS-26, No. 2, pp. 2775-2779, Apr. 1979.
K. Lange, et al., "A Theoretical Study of Some Maximum
Likelihood Algorithms for Emission and Transmission
Tomography," *IEEE Trans. on Medical Imaging*, vol. MI-6,
No. 2, pp.106-114, Jun. 1987.

(List continued on next page.)

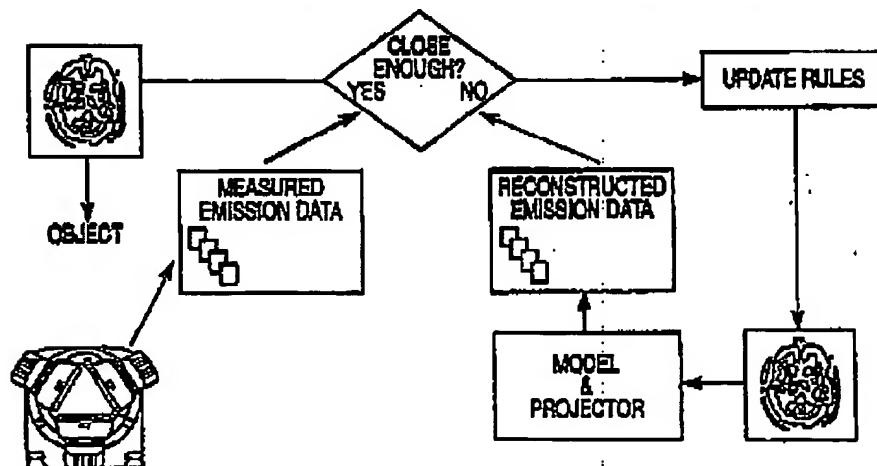
Primary Examiner—Joseph Mancuso
Assistant Examiner—Abelital Tobsthal

(74) Attorney, Agent, or Firm—Fay, Sharpe, Fagan,
Minnich & McKee, LLP

(57) **ABSTRACT**

A method of ML-EM image reconstruction is provided for
use in connection with a diagnostic imaging apparatus (10)
that generates projection data. The method includes collect-
ing projection data, including measured emission projection
data. An initial emission map and attenuation map are
assumed. The emission map and the attenuation map are
iteratively updated. With each iteration, the emission map is
recalculated by taking a previous emission map and adjust-
ing it based upon: (i) the measured emission projection data;
(ii) a reprojection of the previous emission map which is
carried out with a multi-dimensional projection model; and,
(iii) a reprojection of the attenuation map. As well, with each
iteration, the attenuation map is recalculated by taking a
previous attenuation map and adjusting it based upon: (i) the
measured emission projection data; and, (ii) a reprojection of
the previous emission map which is carried out with the
multi-dimensional projection model. In a preferred
embodiment, with source-assisted reconstruction, the recal-
culation of the attenuation map is additionally based upon:
(iii) measured transmission projection data; and, (iv) a
reference or blank data set of measured transmission pro-
jection data taken without the subject present to the imaging
apparatus (10).

27 Claims, 8 Drawing Sheets



REST AVAILABLE COPY